

Errata

For *Socioeconomic Impact Analysis of Marine Reserve Alternatives for the Channel Islands National Marine Sanctuary*

April 8, 2003

The following pages contain revisions and corrections of the analysis document dated April 29, 2002. They have been incorporated into the version of the analysis document dated April 8, 2003. These changes are described below.

Commercial Fishing

- Typos in the text describing the Step 1 analysis for the preferred alternative were corrected (Page 50).

The remaining changes in this errata document are based on a review from the Science and Statistical Committee (SSC) of the Pacific Fishery Management Council (PFMC). Changes to the document were based on the following.

Consumptive Recreation (pages 30-31 and 57-68)

- Estimates from Rowe et al. (1985) have been dropped from the calculation of the recreation consumers' surplus parameter.
- We have expanded the range of parameters taken from Wegge et al. and altered our conversion of per-trip values to per-day values. We used all estimates for the appropriate boat modes from the conventional travel cost demand model and the contingent valuation model. We did not use results from the time demand model presented in Wegge et al. because data were insufficient to provide statistically reliable estimates for all modes of fishing. The authors used the conventional demand model results in their estimation of gross economic value and based on that reasoning, that is what we choose to use in our analysis.
- Regarding the conversion of per-trip estimates to per-day estimates, we have made the following adjustment to our parameter calculation. Estimations of values for a one-day trip were factored into the average unaltered. For private boat trips, length of trip was given in ours instead of days, with the average number of hours being twenty-two (22). Because we required a per-day estimate, we proceeded on the assumption that 22 hours translated into about three days (based on a typical fishing day being six to eight hours). For the contingent valuation estimates, the breakdown of single day and multi-day trips was not given. We proceeded on the assumption that half of the trips were single day trips, (which is consistent with the assumption made in our analysis that half of the users are study area residents). We then calculate a weighted average with half of the estimate used unaltered and half divided by the average trip length of 4.13.

- Because estimates in Wegge, et al. are in 1984 dollars we have adjusted our parameter estimate to 1999 dollars.

In making these changes, we now characterize our estimates of impacts to consumptive recreational users as a probable overestimation of actual impacts. The values found in table 1.20 represent loss of access to all of southern California. Using these values for the CINMS overstates the values, since values would be expected to decline as the scope of access is reduced.

Non-consumptive Recreation (pages 90-101, 114)

- The change described in consumptive recreation (above) also affected the consumers' surplus estimates for non-consumptive recreation. These have also been revised appropriately.
- The range of elasticities used to estimate potential benefits to non-consumptive users was changed to incorporate quality elasticities for marine recreation derived from information in Freeman (1995).

Net Benefit Assessment (page 107–110)

- A revised net benefits assessment concluded that the study area includes an insignificant portion of the total supply of commercial fishing catch and results in no impact on prices, therefore, there are no consumers' surplus losses. Although we still maintain there are no economic rents or negative economic rents due to overfishing, we have relaxed the benefit-cost analysis assumptions that the economy is at full employment and that labor and capital are mobile and can find alternative employment. We estimate the losses in returns to labor and capital as a percent of harvest revenue and apply this to the estimated maximum potential harvest revenue loss for each marine reserve alternative. We also expand the policy analysis to include two scenarios for the percentage of U.S. households that would be willing to pay the three dollar amounts per household per year to one and two percent. We also added justification of why one and two percent of households represent extremely conservative (lower-bound) assumptions in the policy analysis.

Table 1.20 Consumers' Surplus Estimates for Recreation Activities

Mode	Activity	Geographic Coverage	Method	Per day Value	
Charter/Party Boat	Fishing	Northern border of San Luis Obispo County to Mexican border and 40 miles inland (by zip code).	TC ²	Charter boat-day trip	
				Boat Owners (1984\$)	\$ 22.00
			Do not own boat (1984\$)	\$ 49.00	
			CV ²	Charter boat-more than one day ³	
				Boat Owners (1984\$)	\$ 12.35
				Do not own boat (1984\$)	\$ 15.25
				Charter boat-all trips ⁴ (1984\$)	\$ 13.97
				Average⁵ (1984\$)	\$ 22.51
				Adjusted to 1999 dollars	\$ 36.09
			Private Boat		
Boat Owners ⁵ (1984\$)	\$ 24.67				
Do not own boat ⁵ (1984\$)	\$ 20.33				
CV ²	Charter boat-all trips (1984\$)	\$ 20.00			
	Average⁶ (1984\$)	\$ 21.67			
	Adjusted to 1999 dollars	\$ 34.75			

1. Source: Wegge, et. al. 1984 (see the References section for full citations).

2. TC=Travel Cost Model, CV=Contingent Valuation Method

3. Travel cost values given for multi-day trip estimates in the report were person-trip estimates. TC multi-day estimates were translated into person-day estimates by dividing by the multi-day average number of trips (4.13).

4. We did not have the breakdown of length of trips associated with this estimate, therefore we assumed that half of trips were day trips and half were multi-day trips and calculated a weighted average. This is consistent with our assumption that half of the consumptive users are residents and half are from out of the study area.

5. Length of trip for private trips was given in terms of hours fished, with an average of 22. We assumed the length of an average day was 6 to 8 hours and so divided these person-trip estimates by three (3) to get a person days estimate.

6. The report also included travel cost values based on a time demand model. We did not include these here because the method of incorporating the value of time did not perform well and had a large influence on the results.

Table 1.21 Baseline Consumptive Recreation Activity

	Charter/Party Boat Fishing	Charter/Party Boat Diving	Private Boat Fishing	Private Boat Diving
Person-days	158,768	17,934	214,015	47,190
Market Impact				
Direct Sales	\$ 20,638,407	\$ 3,008,782	\$ 8,888,043	\$ 2,595,450
Direct Wages and Salaries	\$ 9,475,042	\$ 1,449,065	\$ 2,499,255	\$ 683,447
Direct Employment	279	48	85	24
Total Income				
Upper Bound	\$ 16,581,324	\$ 2,535,864	\$ 4,373,697	\$ 1,196,032
Lower Bound	\$ 14,212,564	\$ 2,173,598	\$ 3,748,883	\$ 1,025,171
Total Employment				
Upper Bound	418	72	127	37
Lower Bound	348	60	106	31
Non-Market Impact				
Consumer's Surplus ¹	\$ 5,730,586	\$ 647,294	\$ 7,436,397	\$ 1,639,715
Profit ²	\$ 376,295	\$ 44,004	n/a	n/a

1. Consumer's Surplus is calculated by multiplying the consumer's surplus per person per day averages from Table 1.20 by the number of person days in this table.

2. Profit is used as a proxy for producer's surplus.

Table 1.22. Baseline Non-consumptive Recreation Activity

	Whale Watching	NC Diving	Sailing	Kayaking/ Sightseeing
Person-days	25,984	10,776	4,015	1,233
Market Impact				
Direct Sales	\$ 4,288,337	\$ 1,858,879	\$ 694,305	\$ 257,489
Direct Wages and Salaries	\$ 2,084,969	\$ 899,833	\$ 326,370	\$ 129,259
Direct Employment	72	31	10	5
Total Income				
Upper Bound	\$ 3,648,695	\$ 1,574,708	\$ 571,147	\$ 226,203
Lower Bound	\$ 3,127,453	\$ 1,349,750	\$ 489,554	\$ 193,888
Total Employment				
Upper Bound	108	47	16	8
Lower Bound	90	39	13	7
Non-Market Impact				
Consumer's Surplus ¹	\$ 937,866	\$ 388,931	\$ 144,917	\$ 44,504
Profit ²	\$ 157,235	\$ 46,313	\$ 18,020	\$ 2,767

1. Consumer's Surplus is calculated by multiplying the consumer's surplus per person per day averages from Table 1.20 by the number of person days in this table.

2. Profit is used as a proxy for producer's surplus.

A Note on our Baseline Estimates. Above we discussed our choices of the 1996-1999 annual averages for the commercial fisheries and the 1999 estimates of use for the recreational consumptive users as baselines and for extrapolating future impacts. Scholz (2001) has questioned our selection of the 1996-1999 averages for extrapolating about future impacts and argues that our 1996-1999 averages are too high. Scholz cites the declining trends in the value of the entire California commercial fishery over the last 20 years, noting an average annual decline of 6.6%. Scholz also cites recent changes in fishing regulations in the limited entry fixed gear fishery off California by the NMFS to conclude our 1996-1999 baseline is not sustainable. Also cited is a CDFG recommended emergency closure of all offshore rockfish and lingcod sport fisheries south of Cape Mendocino, which would suggest that our baseline 1999 estimates for the recreational or sports fisheries are also not sustainable. Scholz also discusses the noted differences in the overall trends of the commercial fisheries in the CINMS versus the State of California (included here in Appendix C) and concludes that this represents a shift of effort from other California waters suffering from declining stocks and increasing regulations. In addition to being driven by changes in resource availability and regulation along the mainland, changes in fishing technology that have enabled fishermen to venture further from port, and the development of shore-side receiving and processing infrastructure have facilitated the further exploration and increased use of these fishing grounds (Pomeroy et. al. in press). Here the point is about the possibility of there being excess capacity in the commercial fisheries and whether the current capacity is sustainable in the future. Of course Scholz (2001) did not offer an alternative estimate of baselines for extrapolation because any estimate about the future as we noted above is fraught with uncertainty and could be just as vigorously criticized as our estimates. However, these are important issues and will be addressed in our Step 2 analyses.

Table 2.21 Commercial Fishing & Kelp: Impact of Preferred Alternative on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters		Federal Waters		Total	
	Value	% ¹	Value	%	Value	%
Squid	\$ 1,660,718	12.73	\$ 51,230	0.39	\$ 1,711,948	13.12
Kelp ²	\$ 332,794	5.55	\$ -	0.00	\$ 332,794	5.55
Urchins	\$ 830,464	15.77	\$ 2,687	0.05	\$ 833,151	15.82
Spiny Lobster	\$ 149,133	16.17	\$ -	0.00	\$ 149,133	16.17
Prawn	\$ 58,615	8.34	\$ 58,832	8.37	\$ 117,447	16.70
Rockfish	\$ 87,985	16.02	\$ 29,653	5.40	\$ 117,638	21.42
Crab	\$ 50,139	14.59	\$ -	0.00	\$ 50,139	14.59
Tuna	\$ 8,544	2.80	\$ 31,991	10.47	\$ 40,535	13.26
Wetfish	\$ 28,511	9.46	\$ 33,162	11.00	\$ 61,673	20.46
CA Sheepshead	\$ 38,622	16.37	\$ -	0.00	\$ 38,622	16.37
Flatfishes	\$ 22,652	12.32	\$ 3,000	1.63	\$ 25,652	13.95
Sea Cucumbers	\$ 27,731	16.54	\$ -	0.00	\$ 27,731	16.54
Sculpin & Bass	\$ 6,865	11.38	\$ 3,189	5.29	\$ 10,054	16.67
Shark	\$ 4,879	14.04	\$ 720	2.07	\$ 5,599	16.11
Total	\$ 3,307,652	11.77	\$ 214,463	0.76	\$ 3,522,116	12.53

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.22). The greatest potential impact of this alternative, in terms of percent of total port ex vessel revenue, is on the ports in Santa Barbara (12.6%). In absolute amount, Port Hueneme would potentially lose the greatest amount (over \$1.4 million or 10.7% of all ex vessel revenue of landings at the port). Channels Islands Harbor would potentially lose about \$218 thousand or 4.7%. Ventura Harbor would potentially lose 2.9% of the ex vessel of all landings, while San Pedro would potentially lose about 1%. All the other ports would potentially lose extremely small amounts.

Table 2.22 Commercial Fishing & Kelp: Impact of Preferred Alternative on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters		Federal Waters		Total	
	Value	% ¹	Value	%	Value	%
1. Moss Landing	\$9	N/A	\$10	N/A	\$19	N/A
2. Morro Bay	\$63	1.23	\$0	0.00	\$63	1.23
3. Avila/Port San Luis	\$40	0.00	\$5	0.00	\$45	0.00
4. Santa Barbara	\$1,050,864	12.23	\$31,396	0.37	\$1,082,260	12.60
5. Ventura Harbor	\$146,603	2.72	\$10,240	0.19	\$156,843	2.91
6. Channel Islands	\$165,905	3.39	\$52,642	1.08	\$218,547	4.47
7. Port Hueneme	\$1,384,342	10.15	\$73,517	0.54	\$1,457,859	10.69
8. San Pedro	\$158,937	1.14	\$11,445	0.08	\$170,382	1.22
9. Terminal Island	\$46,683	0.26	\$30,688	0.17	\$77,371	0.43
10. Avalon & Other LA	\$252	0.01	\$8	0.00	\$260	0.01
11. Newport Beach	\$9	0.00	\$24	0.00	\$33	0.00
12. San Diego	\$4,538	0.13	\$194	0.01	\$4,732	0.14

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.23) is little over 10.6 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties, with about \$1.2 million

Table 2.30. Summary: Recreation Consumptive Activities - Preferred Alternative - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	77,908	63,322	81.3%	14,586	18.7%
Market Impact					
Direct Sales	\$ 6,139,074	\$ 4,824,499	78.6%	\$ 1,314,575	21.4%
Direct Wages and Salaries	\$ 2,429,728	\$ 1,876,605	77.2%	\$ 553,123	22.8%
Direct Employment	76	59	78.0%	17	22.0%
Total Income					
Upper Bound	\$ 4,252,025	\$ 3,284,059	77.2%	\$ 967,966	22.8%
Lower Bound	\$ 3,644,593	\$ 2,814,908	77.2%	\$ 829,685	22.8%
Total Employment					
Upper Bound	114	89	78.0%	25	22.0%
Lower Bound	95	74	78.0%	21	22.0%
Non-Market Impact					
Consumer's Surplus	\$ 2,746,600	\$ 2,229,262	81.2%	\$ 517,338	18.8%
Profit ¹	\$ 70,419	\$ 52,125	74.0%	\$ 18,294	26.0%

1. Profit is used as a proxy for producer's surplus.

Table 2.31. Recreation Consumptive Activities - Preferred Alternative - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	25,767	16.23%	3,579	19.95%	36,381	17.00%	12,182	25.81%
Market Impact								
Direct Sales	\$ 3,354,260	16.25%	\$ 603,913	20.07%	\$ 1,510,907	17.00%	\$ 669,994	25.81%
Direct Wages and Salaries	\$ 1,539,350	16.25%	\$ 289,218	19.96%	\$ 424,830	17.00%	\$ 176,330	25.80%
Direct Employment	45	16.35%	10	19.95%	14	16.77%	6	26.33%
Total Income								
Upper Bound	\$ 2,693,862	15.83%	\$ 506,132	18.70%	\$ 743,453	16.63%	\$ 308,578	23.90%
Lower Bound	\$ 2,309,024	15.92%	\$ 433,827	18.96%	\$ 637,245	16.71%	\$ 264,496	24.29%
Total Employment								
Upper Bound	68	15.90%	14	18.90%	22	16.77%	9	24.30%
Lower Bound	57	16.05%	12	19.00%	18	16.84%	8	24.68%
Non-Market Impact								
Consumer's Surplus	\$ 930,020	16.23%	\$ 129,164	19.96%	\$ 1,264,137	17.00%	\$ 423,279	25.81%
Profit ¹	\$ 61,443	16.33%	\$ 8,977	20.40%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Reserve Types. The Preferred Alternative includes 12 individual reserve sites (see Appendix G for an analysis by reserve), with three types of reserves. Ten of these reserves are “Marine Reserves,” which are *no-take areas*, meaning that consumptive activity of any kind is prohibited. One of the reserves, Anacapa Island, is a “Marine Conservation Area.” This type of reserve allows for the taking of spiny lobster (*panulirus interruptus*) and pelagic finfish. Although recreational fishing or consumptive diving data were not collected by species, the Recreational Fisheries Information Network (RecFIN) fishing location add-on to the Marine Recreational Fisheries Statistics Survey (MRFSS) was used to estimate the proportion of recreational pelagic finfish by California Department of Fish and Game (CDFG) fish block. Using this proportion to eliminate pelagic finfish from the analysis, the model only takes into account prohibited species of finfish for this alternative. Unfortunately, the sample did not include data for recreational take of spiny lobster. As a result, this analysis may be an overestimate of actual maximum potential impact. The final reserve type is “Marine Park.” One of the reserves, Painted Cave, falls in to this category. In this reserve no consumptive activities are permitted except for the recreational take of spiny lobster. As was stated above, the data do not include specific information on the distribution of spiny lobster, therefore this analysis may be an overestimate of actual maximum potential impact.

Preferred Alternative: Breakout by Jurisdiction. Although just over half of the Preferred Alternative lies in state waters, a much higher percentage of consumptive activities take place within the state boundary. Overall, 81.3% of consumptive use, in terms of person-days, takes place in state waters (i.e., areas that are more shallow and closer to shore). Not surprisingly, a higher percentage of diving takes place in state waters (90.4% and 95.4% of charter/party boat and private boat diving, respectively). The proportion of charter/party boat fishing that takes place in state waters is less than the overall percentage (71.1%), while

the proportion of private boat fishing is just over the overall proportion (82.9%). See Tables 2.32 and 2.33 for details.

Table 2.32. Recreation Consumptive Activities - Preferred Alternative - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	18,312	11.53%	3,236	18.05%	30,148	14.09%	11,625	24.63%
Market Impact								
Direct Sales	\$ 2,387,756	11.57%	\$ 545,336	18.12%	\$ 1,252,048	14.09%	\$ 639,359	24.63%
Direct Wages and Salaries	\$ 1,094,442	11.55%	\$ 261,768	18.06%	\$ 352,032	14.09%	\$ 168,364	24.63%
Direct Employment	32	11.68%	9	18.06%	12	13.96%	6	24.91%
Total Income								
Upper Bound	\$ 1,915,274	11.55%	\$ 458,094	18.06%	\$ 616,055	14.09%	\$ 294,636	24.63%
Lower Bound	\$ 1,641,663	11.55%	\$ 392,652	18.06%	\$ 528,047	14.09%	\$ 252,545	24.63%
Total Employment								
Upper Bound	49	11.66%	13	18.06%	18	14.07%	9	24.92%
Lower Bound	41	11.67%	11	18.06%	15	14.03%	8	24.51%
Non-Market Impact								
Consumer's Surplus	\$ 660,970	11.53%	\$ 116,811	18.05%	\$ 1,047,556	14.09%	\$ 403,925	24.63%
Profit ¹	\$ 44,074	11.71%	\$ 8,051	18.30%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.33. Recreation Consumptive Activities - Preferred Alternative - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	7,454	4.69%	342	1.91%	6,233	2.91%	557	1.18%
Market Impact								
Direct Sales	\$ 966,504	4.68%	\$ 58,577	1.95%	\$ 258,860	2.91%	\$ 30,635	1.18%
Direct Wages and Salaries	\$ 444,907	4.70%	\$ 27,450	1.89%	\$ 72,799	2.91%	\$ 7,967	1.17%
Direct Employment	13	4.67%	1	1.89%	2	2.89%	0	1.19%
Total Income								
Upper Bound	\$ 778,588	4.70%	\$ 48,038	1.89%	\$ 127,398	2.91%	\$ 13,942	1.17%
Lower Bound	\$ 667,361	4.70%	\$ 41,176	1.89%	\$ 109,198	2.91%	\$ 11,950	1.17%
Total Employment								
Upper Bound	19	4.66%	1	1.89%	4	2.91%	0	1.19%
Lower Bound	16	4.66%	1	1.89%	3	2.90%	0	1.17%
Non-Market Impact								
Consumer's Surplus	\$ 269,050	4.69%	\$ 12,353	1.91%	\$ 216,581	2.91%	\$ 19,354	1.18%
Profit ¹	\$ 17,369	4.62%	\$ 925	2.10%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 1. In terms of impact on consumptive activities this is the least costly marine reserve alternative. It is significantly smaller than the preferred alternative in terms of both market and non-market impacts. The aggregate maximum potential loss to income for all consumptive recreation activities is about \$2.4 million dollars or 9.7% of the income generated by recreational consumptive activities in the study area (See Table 2.34). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 20,469 person-days, followed by charter/party boat fishing with 16,345 person-days, private boat diving with 2,409 person-days and charter/party boat diving with 1,456 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of \$1.7 million, followed by private boat fishing with \$418 thousand, charter/party boat diving with \$203 thousand and private boat diving with \$61 thousand.

Table 2.34. Summary: Recreation Consumptive Activities - Alternative 1 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	40,679	32,585	80.1%	8,093	19.9%
Market Impact					
Direct Sales	\$ 3,352,951	\$ 2,682,838	80.0%	\$ 670,114	20.0%
Direct Wages and Salaries	\$ 1,372,910	\$ 1,097,074	79.9%	\$ 275,836	20.1%
Direct Employment	43	34	80.4%	8	19.6%
Total Income					
Upper Bound	\$ 2,402,592	\$ 1,919,879	79.9%	\$ 482,713	20.1%
Lower Bound	\$ 2,059,364	\$ 1,645,610	79.9%	\$ 413,754	20.1%
Total Employment					
Upper Bound	64	51	80.4%	13	19.6%
Lower Bound	53	43	80.4%	10	19.6%
Non-Market Impact					
Consumer's Surplus	\$ 1,437,436	\$ 1,151,218	80.1%	\$ 286,218	19.9%
Profit ¹	\$ 42,086	\$ 33,439	79.5%	\$ 8,647	20.5%

1. Profit is used as a proxy for producer's surplus.

Table 2.35. Recreation Consumptive Activities - Alternative 1 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	16,345	10.29%	1,456	8.12%	20,469	9.56%	2,409	5.10%
Market Impact								
Direct Sales	\$ 2,131,987	10.33%	\$ 238,408	7.92%	\$ 850,074	9.56%	\$ 132,482	5.10%
Direct Wages and Salaries	\$ 983,138	10.38%	\$ 115,823	7.99%	\$ 239,051	9.56%	\$ 34,897	5.11%
Direct Employment	29	10.54%	4	8.27%	8	9.48%	1	5.20%
Total Income								
Upper Bound	\$ 1,720,492	10.11%	\$ 202,691	7.49%	\$ 418,340	9.36%	\$ 61,069	4.73%
Lower Bound	\$ 1,474,708	10.17%	\$ 173,735	7.59%	\$ 358,577	9.40%	\$ 52,345	4.81%
Total Employment								
Upper Bound	44	10.25%	6	7.83%	12	9.41%	2	4.80%
Lower Bound	37	10.35%	5	7.87%	10	9.44%	2	4.95%
Non-Market Impact								
Consumer's Surplus	\$ 589,959	10.30%	\$ 52,544	8.12%	\$ 711,235	9.56%	\$ 83,698	5.10%
Profit ¹	\$ 38,674	10.28%	\$ 3,412	7.75%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 1: Breakout by Jurisdiction. The proportion of consumptive usage in the state waters of Alternative 1 is similar to the proportion of the Preferred Alternative consumptive usage taking place within state waters. Overall, 80.1% of consumptive usage, in terms of person-days, takes place in state waters. A higher percentage of diving takes place in state waters (91.8% and 92.5% of charter/party boat and private boat diving, respectively). The percentage of fishing that takes place in state waters is less than the overall percentage of fishing (78% and 79.5 percent of charter/party boat and private boat respectively). See Tables 2.36 and 2.37 for details.

Table 2.36. Recreation Consumptive Activities - Alternative 1 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	12,752	8.03%	1,337	7.46%	16,267	7.60%	2,229	4.72%
Market Impact								
Direct Sales	\$ 1,666,068	8.07%	\$ 218,625	7.27%	\$ 675,571	7.60%	\$ 122,574	4.72%
Direct Wages and Salaries	\$ 768,553	8.11%	\$ 106,221	7.33%	\$ 189,973	7.60%	\$ 32,327	4.73%
Direct Employment	23	8.29%	4	7.60%	6	7.54%	1	4.81%
Total Income								
Upper Bound	\$ 1,344,968	8.11%	\$ 185,887	7.33%	\$ 332,452	7.60%	\$ 56,572	4.73%
Lower Bound	\$ 1,152,829	8.11%	\$ 159,332	7.33%	\$ 284,959	7.60%	\$ 48,490	4.73%
Total Employment								
Upper Bound	35	8.27%	5	7.60%	10	7.60%	2	4.81%
Lower Bound	29	8.27%	5	7.60%	8	7.57%	1	4.73%
Non-Market Impact								
Consumer's Surplus	\$ 460,287	8.03%	\$ 48,260	7.46%	\$ 565,233	7.60%	\$ 77,438	4.72%
Profit ¹	\$ 30,310	8.05%	\$ 3,130	7.11%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.37. Recreation Consumptive Activities - Alternative 1 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	3,593	2.26%	119	0.66%	4,202	1.96%	180	0.38%
Market Impact								
Direct Sales	\$ 465,919	2.26%	\$ 19,783	0.66%	\$ 174,503	1.96%	\$ 9,908	0.38%
Direct Wages and Salaries	\$ 214,585	2.26%	\$ 9,602	0.66%	\$ 49,078	1.96%	\$ 2,570	0.38%
Direct Employment	6	2.25%	0	0.67%	2	1.95%	0	0.39%
Total Income								
Upper Bound	\$ 375,524	2.26%	\$ 16,804	0.66%	\$ 85,887	1.96%	\$ 4,498	0.38%
Lower Bound	\$ 321,878	2.26%	\$ 14,403	0.66%	\$ 73,618	1.96%	\$ 3,855	0.38%
Total Employment								
Upper Bound	9	2.25%	0	0.67%	2	1.96%	0	0.39%
Lower Bound	8	2.25%	0	0.67%	2	1.96%	0	0.38%
Non-Market Impact								
Consumer's Surplus	\$ 129,673	2.26%	\$ 4,284	0.66%	\$ 146,002	1.96%	\$ 6,259	0.38%
Profit ¹	\$ 8,364	2.22%	\$ 283	0.64%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

One other important point to mention is that due to there not being a reserve in the Santa Barbara region of the study area, the impact of this alternative on Los Angeles County will be lower (7% in terms of person-days of activity). Because of the distance to the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles County. The maximum potential loss to this group of users, will therefore be less than it will be for other groups of recreational fishers.

Alternative 2. In terms of impact on consumptive activities Alternative 2 is slightly smaller than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about \$3.9 million dollars or 15.8% of the income generated by recreational consumptive activity in the study area (See Table 2.38). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 33,956 person-days, followed by charter/party boat fishing with 22,981 person-days, private boat diving with 11,299 person-days and charter/party boat diving with 3,639 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of \$2.4 million, followed by private boat fishing with \$694 thousand, charter/party boat diving with \$520 thousand and private boat diving with \$286 thousand.

Table 2.38. Summary: Recreation Consumptive Activities - Alternative 2 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	71,875	59,451	82.7%	12,424	17.3%
Market Impact					
Direct Sales	\$ 5,632,831	\$ 4,527,946	80.4%	\$ 1,104,886	19.6%
Direct Wages and Salaries	\$ 2,234,694	\$ 1,769,845	79.2%	\$ 464,849	20.8%
Direct Employment	70	56	80.0%	14	20.0%
Total Income					
Upper Bound	\$ 3,910,714	\$ 3,097,229	79.2%	\$ 813,485	20.8%
Lower Bound	\$ 3,352,040	\$ 2,654,767	79.2%	\$ 697,273	20.8%
Total Employment					
Upper Bound	105	84	80.0%	21	20.0%
Lower Bound	87	70	80.0%	17	20.0%
Non-Market Impact					
Consumer's Surplus	\$ 2,533,299	\$ 2,092,763	82.6%	\$ 440,536	17.4%
Profit ¹	\$ 62,683	\$ 47,436	75.7%	\$ 15,247	24.3%

1. Profit is used as a proxy for producer's surplus.

Table 2.39. Recreation Consumptive Activities - Alternative 2 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	22,981	14.47%	3,639	20.29%	33,956	15.87%	11,299	23.94%
Market Impact								
Direct Sales	\$ 2,988,969	14.48%	\$ 612,212	20.35%	\$ 1,410,210	15.87%	\$ 621,440	23.94%
Direct Wages and Salaries	\$ 1,377,478	14.54%	\$ 297,005	20.50%	\$ 396,555	15.87%	\$ 163,656	23.95%
Direct Employment	41	14.62%	10	20.35%	13	15.65%	6	24.43%
Total Income								
Upper Bound	\$ 2,410,587	14.16%	\$ 519,759	19.20%	\$ 693,971	15.52%	\$ 286,397	22.18%
Lower Bound	\$ 2,066,217	14.24%	\$ 445,508	19.47%	\$ 594,832	15.60%	\$ 245,483	22.55%
Total Employment								
Upper Bound	61	14.21%	15	19.28%	20	15.65%	9	22.55%
Lower Bound	51	14.35%	12	19.38%	17	15.72%	7	22.90%
Non-Market Impact								
Consumer's Surplus	\$ 829,460	14.48%	\$ 131,349	20.29%	\$ 1,179,887	15.87%	\$ 392,604	23.94%
Profit ¹	\$ 53,942	14.34%	\$ 8,741	19.86%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 2: Breakout by Jurisdiction. About 67% of Alternative 2 lies in state waters, although a higher percentage of fishing and a significantly higher percentage of diving occurs within the state boundary. Overall, 82.7% of consumptive usage, in terms of person-days, takes place in state waters. A higher percentage of diving takes place in state waters (90.4% and 95.4% of charter/party boat and private boat diving, respectively). The proportion of charter/party boat fishing is less than the overall percentage (71.1%) and the proportion of private boat fishing is slightly higher than the overall percentage (82.9%). See Table 2.40 and 2.41 for details.

Table 2.40. Recreation Consumptive Activities - Alternative 2 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	16,615	10.46%	3,447	19.22%	28,385	13.26%	11,004	23.32%
Market Impact								
Direct Sales	\$ 2,164,101	10.49%	\$ 579,796	19.27%	\$ 1,178,848	13.26%	\$ 605,200	23.32%
Direct Wages and Salaries	\$ 997,646	10.53%	\$ 281,282	19.41%	\$ 331,484	13.26%	\$ 159,432	23.33%
Direct Employment	30	10.64%	9	19.28%	11	13.15%	6	23.59%
Total Income								
Upper Bound	\$ 1,745,881	10.53%	\$ 492,244	19.41%	\$ 580,097	13.26%	\$ 279,006	23.33%
Lower Bound	\$ 1,496,469	10.53%	\$ 421,924	19.41%	\$ 497,226	13.26%	\$ 239,148	23.33%
Total Employment								
Upper Bound	44	10.62%	14	19.28%	17	13.25%	9	23.59%
Lower Bound	37	10.63%	12	19.28%	14	13.21%	7	23.20%
Non-Market Impact								
Consumer's Surplus	\$ 599,684	10.46%	\$ 124,423	19.22%	\$ 986,312	13.24%	\$ 382,344	23.17%
Profit ¹	\$ 39,158	10.41%	\$ 8,279	18.81%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.41. Recreation Consumptive Activities - Alternative 2 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	6,366	4.01%	192	1.07%	5,571	2.60%	295	0.63%
Market Impact								
Direct Sales	\$ 824,868	4.00%	\$ 32,416	1.08%	\$ 231,362	2.60%	\$ 16,239	0.63%
Direct Wages and Salaries	\$ 379,832	4.01%	\$ 15,723	1.09%	\$ 65,071	2.60%	\$ 4,224	0.62%
Direct Employment	11	3.98%	1	1.07%	2	2.58%	0	0.63%
Total Income								
Upper Bound	\$ 664,706	4.01%	\$ 27,515	1.09%	\$ 113,874	2.60%	\$ 7,391	0.62%
Lower Bound	\$ 569,748	4.01%	\$ 23,584	1.09%	\$ 97,606	2.60%	\$ 6,335	0.62%
Total Employment								
Upper Bound	17	3.97%	1	1.07%	3	2.60%	0	0.63%
Lower Bound	14	3.97%	1	1.07%	3	2.59%	0	0.62%
Non-Market Impact								
Consumer's Surplus	\$ 229,775	4.01%	\$ 6,926	1.07%	\$ 193,575	2.60%	\$ 10,259	0.63%
Profit ¹	\$ 14,784	3.93%	\$ 463	1.05%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Because this alternative does not have a reserve in the Santa Barbara region, one would expect the impact of this alternative on Los Angeles County users to be lower. Because of the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles County. However, because this alternative encompasses the entire region in which users from Los Angeles operate, and users from Los Angeles do operate in the proximity of Santa Cruz and Anacapa Islands, the relative impacts to Los Angeles County and the study area in general are similar (about 16% in terms of person-days).

Reserve Types. The Alternative 2 includes 11 individual reserve sites, with two types of reserves. Eight of these reserves are Marine Reserves. Three of the reserves, Carrington Point, Scorpion (East and West), and Anacapa Island, are Marine Conservation Areas. This type of reserve allows for the taking of spiny lobster and pelagic finfish. Although recreational fishing or consumptive diving data by species was not collected, the RecFIN fishing location add-on to the MRFSS was used to estimate the proportion of recreational pelagic finfish by CDFG fish block. Using this proportion to eliminate pelagic finfish from the analysis, the model only takes into account prohibited species of finfish for these reserves. Unfortunately, the sample did not include data for recreational taking of spiny lobsters. As a result, this analysis may be an overestimate of actual maximum potential impact.

Alternative 3. In terms of impact on consumptive activities Alternative 3 is smaller than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about \$2.9 million dollars or 11.6% of the income generated by recreational consumptive activity in the study area (See Table 2.42). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 21,890 person-days, followed by charter/party boat fishing with 20,028 person-days, private boat diving with 2,667 person-days and charter/party boat diving with 1,689 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of \$2.1 million, followed by private boat fishing with \$447 thousand, charter/party boat diving with \$236 thousand and private boat diving with \$68 thousand.

Table 2.42. Summary: Recreation Consumptive Activities - Alternative 3 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	46,273	34,113	73.7%	12,160	26.3%
Market Impact					
Direct Sales	\$ 3,943,786	\$ 2,800,674	71.0%	\$ 1,143,113	29.0%
Direct Wages and Salaries	\$ 1,632,707	\$ 1,143,952	70.1%	\$ 488,756	29.9%
Direct Employment	50	36	71.0%	15	29.0%
Total Income					
Upper Bound	\$ 2,857,238	\$ 2,001,916	70.1%	\$ 855,322	29.9%
Lower Bound	\$ 2,449,061	\$ 1,715,928	70.1%	\$ 733,133	29.9%
Total Employment					
Upper Bound	76	54	71.0%	22	29.0%
Lower Bound	63	45	71.0%	18	29.0%
Non-Market Impact					
Consumer's Surplus	\$ 1,637,119	\$ 1,205,036	73.6%	\$ 432,084	26.4%
Profit ¹	\$ 51,263	\$ 34,738	67.8%	\$ 16,525	32.2%

1. Profit is used as a proxy for producer's surplus.

Table 2.43. Recreation Consumptive Activities - Alternative 3 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	20,028	12.61%	1,689	9.42%	21,890	10.23%	2,667	5.65%
Market Impact								
Direct Sales	\$ 2,610,434	12.65%	\$ 277,598	9.23%	\$ 909,087	10.23%	\$ 146,667	5.65%
Direct Wages and Salaries	\$ 1,203,580	12.70%	\$ 134,838	9.31%	\$ 255,649	10.23%	\$ 38,641	5.65%
Direct Employment	36	12.87%	5	9.57%	9	10.09%	1	5.80%
Total Income								
Upper Bound	\$ 2,106,265	12.38%	\$ 235,967	8.72%	\$ 447,385	10.01%	\$ 67,621	5.24%
Lower Bound	\$ 1,805,370	12.45%	\$ 202,257	8.84%	\$ 383,473	10.06%	\$ 57,961	5.32%
Total Employment								
Upper Bound	54	12.51%	7	9.07%	13	10.09%	2	5.36%
Lower Bound	45	12.64%	6	9.12%	11	10.14%	2	5.44%
Non-Market Impact								
Consumer's Surplus	\$ 722,878	12.62%	\$ 60,973	9.42%	\$ 760,609	10.23%	\$ 92,659	5.65%
Profit ¹	\$ 47,291	12.57%	\$ 3,972	9.03%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 3: Breakout by Jurisdiction. Although about 59% of Alternative 3 lies in state waters, almost 74% of consumptive usage, in terms of person-days, takes place in state waters. Like Alternatives 1 and 2, a higher percentage of diving takes place in state waters (85.6% and 89.6% of charter/party boat and private boat diving, respectively). The percentage of charter/party boat fishing that takes place in state waters is less than the overall percentage of fishing (65.8%) while for private boat fishing, the percentage taking place in state waters is greater than the overall proportion (78.1%). See Tables 2.44 and 2.45 for details.

Table 2.44. Recreation Consumptive Activities - Alternative 3 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	13,180	8.30%	1,446	8.06%	17,098	7.99%	2,390	5.06%
Market Impact								
Direct Sales	\$ 1,722,352	8.35%	\$ 236,790	7.87%	\$ 710,081	7.99%	\$ 131,451	5.06%
Direct Wages and Salaries	\$ 794,563	8.39%	\$ 115,036	7.94%	\$ 199,680	7.99%	\$ 34,672	5.07%
Direct Employment	24	8.57%	4	8.21%	7	7.92%	1	5.16%
Total Income								
Upper Bound	\$ 1,390,486	8.39%	\$ 201,313	7.94%	\$ 349,440	7.99%	\$ 60,677	5.07%
Lower Bound	\$ 1,191,845	8.39%	\$ 172,554	7.94%	\$ 299,520	7.99%	\$ 52,009	5.07%
Total Employment								
Upper Bound	36	8.55%	6	8.21%	10	7.98%	2	5.16%
Lower Bound	30	8.56%	5	8.21%	8	7.96%	2	5.08%
Non-Market Impact								
Consumer's Surplus	\$ 475,706	8.30%	\$ 52,177	8.06%	\$ 594,107	7.99%	\$ 83,046	5.06%
Profit ¹	\$ 31,349	8.33%	\$ 3,389	7.70%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.45. Recreation Consumptive Activities - Alternative 3 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	6,848	4.31%	244	1.36%	4,792	2.24%	277	0.59%
Market Impact								
Direct Sales	\$ 888,082	4.30%	\$ 40,808	1.36%	\$ 199,005	2.24%	\$ 15,217	0.59%
Direct Wages and Salaries	\$ 409,017	4.32%	\$ 19,802	1.37%	\$ 55,968	2.24%	\$ 3,968	0.58%
Direct Employment	12	4.30%	1	1.37%	2	2.22%	0	0.59%
Total Income								
Upper Bound	\$ 715,779	4.32%	\$ 34,654	1.37%	\$ 97,945	2.24%	\$ 6,944	0.58%
Lower Bound	\$ 613,525	4.32%	\$ 29,703	1.37%	\$ 83,952	2.24%	\$ 5,952	0.58%
Total Employment								
Upper Bound	18	4.29%	1	1.37%	3	2.24%	0	0.59%
Lower Bound	15	4.29%	1	1.37%	2	2.23%	0	0.58%
Non-Market Impact								
Consumer's Surplus	\$ 247,172	4.31%	\$ 8,796	1.36%	\$ 166,502	2.24%	\$ 9,614	0.59%
Profit ¹	\$ 15,942	4.24%	\$ 583	1.32%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

One other important point to mention is that due to there not being a reserve in the Santa Barbara region of the study area, the impact of this alternative on Los Angeles County will be lower (8% in terms of person-days of activity). Because of the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles County. The maximum potential loss to this group of users, will therefore be less.

Alternative 4. In terms of impact on consumptive activities Alternative 4 is larger than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about \$5 million dollars or 20.3% of the income generated by recreational consumptive activities in the study area (See Table 2.46). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 40,660 person-days, followed by charter/party boat fishing with 31,962 person-days, private boat diving with 12,088 person-days and charter/party boat diving with 3,751 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of \$3.3 million, followed by private boat fishing with \$831 thousand, charter/party boat diving with \$531 thousand and private boat diving with \$306 thousand.

Table 2.46. Summary: Recreation Consumptive Activities - Alternative 4 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	88,462	69,182	78.2%	19,279	21.8%
Market Impact					
Direct Sales	\$ 7,142,126	\$ 5,298,977	74.2%	\$ 1,843,149	25.8%
Direct Wages and Salaries	\$ 2,862,600	\$ 2,070,691	72.3%	\$ 791,910	27.7%
Direct Employment	89	65	73.4%	24	26.6%
Total Income					
Upper Bound	\$ 5,009,550	\$ 3,623,708	72.3%	\$ 1,385,842	27.7%
Lower Bound	\$ 4,293,900	\$ 3,106,036	72.3%	\$ 1,187,865	27.7%
Total Employment					
Upper Bound	133	98	73.4%	35	26.6%
Lower Bound	111	82	73.4%	29	26.6%
Non-Market Impact					
Consumer's Surplus	\$ 3,121,889	\$ 2,436,333	78.0%	\$ 685,555	22.0%
Profit ¹	\$ 85,268	\$ 58,280	68.3%	\$ 26,988	31.7%

1. Profit is used as a proxy for producer's surplus.

Table 2.47. Recreation Consumptive Activities - Alternative 4 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	31,962	20.13%	3,751	20.92%	40,660	19.00%	12,088	25.62%
Market Impact								
Direct Sales	\$ 4,159,819	20.16%	\$ 628,832	20.90%	\$ 1,688,613	19.00%	\$ 664,862	25.62%
Direct Wages and Salaries	\$ 1,909,430	20.15%	\$ 303,296	20.93%	\$ 474,802	19.00%	\$ 175,073	25.62%
Direct Employment	56	20.27%	10	21.01%	16	18.74%	6	26.15%
Total Income								
Upper Bound	\$ 3,341,502	19.63%	\$ 530,767	19.61%	\$ 830,904	18.58%	\$ 306,377	23.73%
Lower Bound	\$ 2,864,145	19.75%	\$ 454,944	19.89%	\$ 712,203	18.67%	\$ 262,609	24.12%
Total Employment								
Upper Bound	85	19.70%	15	19.90%	24	18.74%	9	24.14%
Lower Bound	70	19.90%	13	20.01%	20	18.83%	8	24.52%
Non-Market Impact								
Consumer's Surplus	\$ 1,153,630	20.13%	\$ 135,403	20.92%	\$ 1,412,819	19.00%	\$ 420,036	25.61%
Profit ¹	\$ 76,111	20.23%	\$ 9,157	20.81%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 4: Breakout by Jurisdiction. Like the preferred alternative, about half of Alternative 4 lies in state waters, however, 78.2% of overall consumptive usage, in terms of person-days, takes place in state waters. A higher percentage of diving (89.8% and 96.9% of charter/party boat and private boat diving, respectively) and private boat fishing (82.1%) takes place in state waters, while the proportion of charter/party boat fishing (64.8%) is lower than the overall percentage. See Table 2.48 and 2.49 for details.

Table 2.48. Recreation Consumptive Activities - Alternative 4 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	20,726	13.05%	3,368	18.78%	33,373	15.59%	11,716	24.83%
Market Impact								
Direct Sales	\$ 2,704,517	13.10%	\$ 564,107	18.75%	\$ 1,385,993	15.59%	\$ 644,360	24.83%
Direct Wages and Salaries	\$ 1,239,357	13.08%	\$ 271,899	18.76%	\$ 389,711	15.59%	\$ 169,724	24.83%
Direct Employment	37	13.26%	9	18.87%	13	15.46%	6	25.13%
Total Income								
Upper Bound	\$ 2,168,875	13.08%	\$ 475,823	18.76%	\$ 681,994	15.59%	\$ 297,016	24.83%
Lower Bound	\$ 1,859,036	13.08%	\$ 407,848	18.76%	\$ 584,566	15.59%	\$ 254,585	24.83%
Total Employment								
Upper Bound	55	13.23%	14	18.87%	20	15.58%	9	25.13%
Lower Bound	46	13.24%	11	18.87%	17	15.53%	8	24.72%
Non-Market Impact								
Consumer's Surplus	\$ 748,077	13.05%	\$ 121,547	18.78%	\$ 1,159,625	15.59%	\$ 407,085	24.83%
Profit ¹	\$ 50,046	13.30%	\$ 8,233	18.71%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.49. Recreation Consumptive Activities - Alternative 4 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	11,236	7.08%	384	2.14%	7,287	3.40%	373	0.79%
Market Impact								
Direct Sales	\$ 1,455,302	7.05%	\$ 64,726	2.15%	\$ 302,620	3.40%	\$ 20,501	0.79%
Direct Wages and Salaries	\$ 670,072	7.07%	\$ 31,397	2.17%	\$ 85,091	3.40%	\$ 5,349	0.78%
Direct Employment	19	7.01%	1	2.14%	3	3.38%	0	0.79%
Total Income								
Upper Bound	\$ 1,172,627	7.07%	\$ 54,945	2.17%	\$ 148,910	3.40%	\$ 9,361	0.78%
Lower Bound	\$ 1,005,109	7.07%	\$ 47,096	2.17%	\$ 127,637	3.40%	\$ 8,023	0.78%
Total Employment								
Upper Bound	29	6.99%	2	2.14%	4	3.40%	0	0.79%
Lower Bound	24	7.00%	1	2.14%	4	3.39%	0	0.78%
Non-Market Impact								
Consumer's Surplus	\$ 405,553	7.08%	\$ 13,856	2.14%	\$ 253,194	3.40%	\$ 12,952	0.79%
Profit ¹	\$ 26,064	6.93%	\$ 924	2.10%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 5. In terms of impact on consumptive activities Alternative 5 is significantly larger than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about \$5.9 million dollars or 23.9% of the income generated in the study area (See Table 2.50). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 47,460 person-days, followed by charter/party boat fishing with 36,568 person-days, private boat diving with 15,341 person-days and charter/party boat diving with 5,128 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of \$3.8 million, followed by private boat fishing with \$970 thousand, charter/party boat diving with \$728 thousand and private boat diving with \$389 thousand.

Table 2.50. Summary: Recreation Consumptive Activities - Alternative 5 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	104,497	81,716	78.2%	22,781	21.8%
Market Impact					
Direct Sales	\$ 8,437,525	\$ 6,289,616	74.5%	\$ 2,147,909	25.5%
Direct Wages and Salaries	\$ 3,378,264	\$ 2,460,811	72.8%	\$ 917,454	27.2%
Direct Employment	105	78	73.9%	27	26.1%
Total Income					
Upper Bound	\$ 5,911,963	\$ 4,306,419	72.8%	\$ 1,605,544	27.2%
Lower Bound	\$ 5,067,397	\$ 3,691,216	72.8%	\$ 1,376,181	27.2%
Total Employment					
Upper Bound	157	116	73.9%	41	26.1%
Lower Bound	131	97	73.9%	34	26.1%
Non-Market Impact					
Consumer's Surplus	\$ 3,687,129	\$ 2,877,611	78.0%	\$ 809,518	22.0%
Profit ¹	\$ 99,431	\$ 68,324	68.7%	\$ 31,107	31.3%

1. Profit is used as a proxy for producer's surplus.

Table 2.51. Recreation Consumptive Activities - Alternative 5 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	36,568	23.03%	5,128	28.60%	47,460	22.18%	15,341	32.51%
Market Impact								
Direct Sales	\$ 4,757,769	23.05%	\$ 865,003	28.75%	\$ 1,971,015	22.18%	\$ 843,737	32.51%
Direct Wages and Salaries	\$ 2,186,026	23.07%	\$ 415,873	28.70%	\$ 554,220	22.18%	\$ 222,145	32.50%
Direct Employment	64	23.19%	14	28.61%	19	21.87%	8	33.18%
Total Income								
Upper Bound	\$ 3,825,545	22.48%	\$ 727,778	26.88%	\$ 969,886	21.69%	\$ 388,754	30.10%
Lower Bound	\$ 3,279,039	22.61%	\$ 623,810	27.27%	\$ 831,331	21.80%	\$ 333,218	30.61%
Total Employment								
Upper Bound	97	22.55%	21	27.10%	28	21.87%	12	30.63%
Lower Bound	81	22.77%	17	27.25%	24	21.98%	10	31.11%
Non-Market Impact								
Consumer's Surplus	\$ 1,319,884	71.80%	\$ 185,103	89.14%	\$ 1,649,098	66.55%	\$ 533,044	97.56%
Profit ¹	\$ 86,727	23.05%	\$ 12,704	28.87%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 5: Breakout by Jurisdiction. Although about 54% of Alternative 5 lies in state waters, 81.3% of consumptive usage, in terms of person-days, takes place in state waters. Like Alternative 4, a higher percentage of diving (90.4% and 95.4% of charter/party boat and private boat diving, respectively) and private boat fishing (82.9%) takes place in state waters, while the proportion of charter/party boat fishing (71.1%) is lower than the overall percentage. See Tables 2.52 and 2.53 for details.

Table 2.52. Recreation Consumptive Activities - Alternative 5 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	23,744	14.96%	4,626	25.79%	38,603	18.04%	14,744	31.24%
Market Impact								
Direct Sales	\$ 3,096,409	15.00%	\$ 779,126	25.90%	\$ 1,603,166	18.04%	\$ 810,914	31.24%
Direct Wages and Salaries	\$ 1,421,247	15.00%	\$ 375,186	25.89%	\$ 450,785	18.04%	\$ 213,593	31.25%
Direct Employment	42	15.19%	12	25.83%	15	17.88%	8	31.62%
Total Income								
Upper Bound	\$ 2,487,182	15.00%	\$ 656,576	25.89%	\$ 788,874	18.04%	\$ 373,787	31.25%
Lower Bound	\$ 2,131,870	15.00%	\$ 562,779	25.89%	\$ 676,178	18.04%	\$ 320,389	31.25%
Total Employment								
Upper Bound	63	15.15%	19	25.83%	23	18.02%	11	31.62%
Lower Bound	53	15.17%	15	25.83%	19	17.97%	10	31.11%
Non-Market Impact								
Consumer's Surplus	\$ 857,016	14.96%	\$ 166,960	25.79%	\$ 1,341,328	18.04%	\$ 512,307	31.24%
Profit ¹	\$ 56,935	15.13%	\$ 11,389	25.88%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.53. Recreation Consumptive Activities - Alternative 5 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area						
Person-days	12,824	8.08%	503	2.80%	8,857	4.14%	597	1.26%
Market Impact								
Direct Sales	\$ 1,661,360	8.05%	\$ 85,877	2.85%	\$ 367,849	4.14%	\$ 32,823	1.26%
Direct Wages and Salaries	\$ 764,779	8.07%	\$ 40,687	2.81%	\$ 103,435	4.14%	\$ 8,553	1.25%
Direct Employment	22	8.00%	1	2.78%	4	4.10%	0	1.27%
Total Income								
Upper Bound	\$ 1,338,363	8.07%	\$ 71,202	2.81%	\$ 181,011	4.14%	\$ 14,967	1.25%
Lower Bound	\$ 1,147,169	8.07%	\$ 61,030	2.81%	\$ 155,153	4.14%	\$ 12,829	1.25%
Total Employment								
Upper Bound	33	7.98%	2	2.78%	5	4.14%	0	1.27%
Lower Bound	28	7.99%	2	2.78%	4	4.12%	0	1.25%
Non-Market Impact								
Consumer's Surplus	\$ 462,868	8.08%	\$ 18,144	2.80%	\$ 307,770	4.14%	\$ 20,737	1.26%
Profit ¹	\$ 29,792	7.92%	\$ 1,315	2.99%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 3.4. Economic Impact Associated with Non-consumptive Activities Preferred Alternative - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	4,105	15.80%	2,197	20.39%	499	12.42%	357	28.96%
Market Impact								
Direct Sales	\$ 682,449	15.9%	\$ 382,600	20.6%	\$ 86,775	12.5%	\$ 74,647	29.0%
Direct Wages and Salaries	\$ 330,700	15.9%	\$ 186,889	20.8%	\$ 40,468	12.4%	\$ 37,477	29.0%
Direct Employment	11	15.2%	6	20.4%	1	12.4%	2	29.0%
Total Income								
Upper Bound	\$ 578,724	15.9%	\$ 327,056	20.8%	\$ 70,820	12.4%	\$ 65,585	29.0%
Lower Bound	\$ 496,050	15.9%	\$ 280,333	20.8%	\$ 60,702	12.4%	\$ 56,216	29.0%
Total Employment								
Upper Bound	16	15.3%	10	20.2%	2	12.2%	2	28.5%
Lower Bound	14	15.3%	8	20.3%	2	12.5%	2	27.1%
Non-Market Impact								
Consumer's Surplus	\$ 148,165	49.2%	\$ 79,313	63.6%	\$ 17,999	38.7%	\$ 12,890	90.3%
Profit ¹	\$ 19,907	12.7%	\$ 9,290	20.1%	\$ 2,549	14.1%	\$ 799	28.9%

1. Profit is used as a proxy for producer's surplus.

Table 3.5. Economic Impact Associated with Non-consumptive Activities - Preferred Alternative - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	3,787	14.57%	1,972	18.30%	440	10.96%	357	28.96%
Market Impact								
Direct Sales	\$ 629,435	14.7%	\$ 342,533	18.4%	\$ 76,877	11.1%	\$ 74,647	29.0%
Direct Wages and Salaries	\$ 305,042	14.6%	\$ 167,288	18.6%	\$ 35,679	10.9%	\$ 37,477	29.0%
Direct Employment	10	14.0%	6	18.3%	1	10.9%	2	29.0%
Total Income								
Upper Bound	\$ 533,824	14.6%	\$ 292,754	18.6%	\$ 62,438	10.9%	\$ 65,585	29.0%
Lower Bound	\$ 457,563	14.6%	\$ 250,932	18.6%	\$ 53,518	10.9%	\$ 56,216	29.0%
Total Employment								
Upper Bound	15	14.1%	9	18.2%	2	10.8%	2	28.5%
Lower Bound	13	14.1%	7	18.2%	1	11.0%	2	27.1%
Non-Market Impact								
Consumer's Surplus	\$ 136,686	14.6%	\$ 71,190	18.3%	\$ 15,885	11.0%	\$ 12,890	29.0%
Profit ¹	\$ 18,509	11.8%	\$ 8,278	17.9%	\$ 2,418	13.4%	\$ 799	28.9%

1. Profit is used as a proxy for producer's surplus.

Table 3.6. Economic Impact Associated with Non-consumptive Activities - Preferred Alternative - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	318	1.22%	225	2.09%	59	1.46%	-	0.00%
Market Impact								
Direct Sales	\$ 53,014	1.2%	\$ 40,067	2.2%	\$ 9,897	1.4%	\$ -	0.0%
Direct Wages and Salaries	\$ 25,658	1.2%	\$ 19,601	2.2%	\$ 4,789	1.5%	\$ -	0.0%
Direct Employment	1	1.2%	1	2.1%	0	1.5%	-	0.0%
Total Income								
Upper Bound	\$ 44,901	1.2%	\$ 34,301	2.2%	\$ 8,381	1.5%	\$ -	0.0%
Lower Bound	\$ 38,486	1.2%	\$ 29,401	2.2%	\$ 7,184	1.5%	\$ -	0.0%
Total Employment								
Upper Bound	1	1.2%	1	2.1%	0	1.4%	-	0.0%
Lower Bound	1	1.2%	1	2.1%	0	1.5%	-	0.0%
Non-Market Impact								
Consumer's Surplus	\$ 11,478	1.2%	\$ 8,123	2.1%	\$ 2,114	1.5%	\$ -	0.0%
Profit ¹	\$ 1,399	0.9%	\$ 1,012	2.2%	\$ 131	0.7%	\$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to the Preferred Alternative. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.7 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in

quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.7 presents a range of benefits with low end in terms of consumer's surplus of \$6,459 with the assumption of a 10% increase in quality and a 0.25 value elasticity of quality and a high end of \$1,162,649 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts range between \$26,055 and \$4,689,833, while employment impacts range between less than one job to 135 new jobs.

Table 3.7. Potential Benefits to Non-consumptive Users from The Preferred Alternative - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.25	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	\$ 6,459	\$ 25,837	\$ 116,265
	Income	\$ 26,055	\$ 104,219	\$ 468,983
	Employment	0.75	3.00	13.50
	Person-days	179	716	3,221
50%				
	Consumer's Surplus	\$ 32,296	\$ 129,183	\$ 581,324
	Income	\$ 130,273	\$ 521,093	\$ 2,344,916
	Employment	3.75	15.00	67.50
	Person-days	895	3,579	16,106
100%				
	Consumer's Surplus	\$ 64,592	\$ 258,366	\$ 1,162,649
	Income	\$ 260,546	\$ 1,042,185	\$ 4,689,833
	Employment	7.50	30.00	135.00
	Person-days	1,790	7,158	32,211

1. Benefits are the aggregate amounts across all non-consumptive activities for The Preferred Alternative

Alternative 1. In terms of impact of non-consumptive activities this is the smallest marine reserve alternative. The aggregate economic impact on income associated with all non-consumptive activities in Alternative 1 is about \$383 thousand dollars or 6.4% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with a baseline of \$182 thousand, followed by non-consumptive diving with \$145 thousand, sailing with \$33 thousand and kayaking/sightseeing with \$23 thousand. Please see Tables 3.8 through 3.10 the remainder of the economic measures and breakout by jurisdiction.

Table 3.8. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	1,290	4.96%	1,042	9.67%	229	5.70%	126	10.19%
Market Impact								
Direct Sales	\$ 214,264	5.0%	\$ 169,595	9.1%	\$ 38,651	5.6%	\$ 26,492	10.3%
Direct Wages and Salaries	\$ 103,868	5.0%	\$ 82,767	9.2%	\$ 18,703	5.7%	\$ 13,315	10.3%
Direct Employment	3	4.8%	3	9.7%	1	5.7%	1	10.4%
Total Income								
Upper Bound	\$ 181,769	5.0%	\$ 144,842	9.2%	\$ 32,731	5.7%	\$ 23,301	10.3%
Lower Bound	\$ 155,802	5.0%	\$ 124,150	9.2%	\$ 28,055	5.7%	\$ 19,973	10.3%
Total Employment								
Upper Bound	5	4.8%	5	9.6%	1	5.6%	1	10.2%
Lower Bound	4	4.8%	4	9.6%	1	5.8%	1	9.7%
Non-Market Impact								
Consumer's Surplus	\$ 46,558	15.5%	\$ 37,617	30.2%	\$ 8,255	17.8%	\$ 4,537	31.8%
Profit ¹	\$ 6,437	4.1%	\$ 3,511	7.6%	\$ 510	2.8%	\$ 275	10.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.9. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	1,288	4.96%	937	8.69%	197	4.91%	126	10.19%
Market Impact								
Direct Sales	\$ 213,891	5.0%	\$ 151,064	8.1%	\$ 33,296	4.8%	\$ 26,492	10.3%
Direct Wages and Salaries	\$ 103,687	5.0%	\$ 73,702	8.2%	\$ 16,112	4.9%	\$ 13,315	10.3%
Direct Employment	3	4.8%	3	8.7%	1	4.9%	1	10.4%
Total Income								
Upper Bound	\$ 181,453	5.0%	\$ 128,978	8.2%	\$ 28,196	4.9%	\$ 23,301	10.3%
Lower Bound	\$ 155,531	5.0%	\$ 110,553	8.2%	\$ 24,168	4.9%	\$ 19,973	10.3%
Total Employment								
Upper Bound	5	4.8%	4	8.6%	1	4.8%	1	10.2%
Lower Bound	4	4.8%	3	8.7%	1	5.0%	1	9.7%
Non-Market Impact								
Consumer's Surplus	\$ 46,477	5.0%	\$ 33,816	8.7%	\$ 7,111	4.9%	\$ 4,537	10.2%
Profit ¹	\$ 6,428	4.1%	\$ 3,054	6.6%	\$ 439	2.4%	\$ 275	10.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.10. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	2	0.01%	105	0.98%	32	0.79%	-	0.00%
Market Impact								
Direct Sales	\$ 373	0.0%	\$ 18,531	1.0%	\$ 5,355	0.8%	\$ -	0.0%
Direct Wages and Salaries	\$ 181	0.0%	\$ 9,065	1.0%	\$ 2,591	0.8%	\$ -	0.0%
Direct Employment	0	0.0%	0	1.0%	0	0.8%	-	0.0%
Total Income								
Upper Bound	\$ 316	0.0%	\$ 15,864	1.0%	\$ 4,535	0.8%	\$ -	0.0%
Lower Bound	\$ 271	0.0%	\$ 13,598	1.0%	\$ 3,887	0.8%	\$ -	0.0%
Total Employment								
Upper Bound	0	0.0%	0	1.0%	0	0.8%	-	0.0%
Lower Bound	0	0.0%	0	1.0%	0	0.8%	-	0.0%
Non-Market Impact								
Consumer's Surplus	\$ 81	0.0%	\$ 3,801	1.0%	\$ 1,144	0.8%	\$ -	0.0%
Profit ¹	\$ 9	0.0%	\$ 457	1.0%	\$ 71	0.4%	\$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 1. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.11 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.11 presents a range of benefits with low end in terms of consumer's surplus of \$2,299 with the assumption of a 10% increase in quality and a 0.25 value elasticity of quality and a high end of \$413,737 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts range between \$9,566 and \$1,721,895, while employment impacts range between less than one job to 51 new jobs.

Table 3.11 Potential Benefits to Non-consumptive Users from Alternative 1 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.25	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	\$ 2,299	\$ 9,194	\$ 41,374
	Income	\$ 9,566	\$ 38,264	\$ 172,189
	Employment	0.29	1.14	5.14
	Person-days	67	269	1,209
50%				
	Consumer's Surplus	\$ 11,493	\$ 45,971	\$ 206,868
	Income	\$ 47,830	\$ 191,322	\$ 860,947
	Employment	1.43	5.72	25.72
	Person-days	336	1,344	6,046
100%				
	Consumer's Surplus	\$ 22,985	\$ 91,941	\$ 413,737
	Income	\$ 95,661	\$ 382,643	\$ 1,721,895
	Employment	2.86	11.43	51.44
	Person-days	672	2,687	12,092

1. Benefits are the aggregate amounts across all non-consumptive activities for Alternative 1

Alternative 2. In terms of impact associated with non-consumptive activities Alternative 2 is slightly larger than the Preferred Alternative. The aggregate economic impact on income associated with all non-consumptive activities is about \$1.03 million dollars or 17.1% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with \$635 thousand, followed by non-consumptive diving with \$295 thousand, sailing with \$77 thousand and kayaking/sightseeing with \$23 thousand. Please see Tables 3.12 through 3.14 the remainder of the economic measures and breakout by jurisdiction.

Table 3.12. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	4,503	17.33%	1,984	18.41%	540	13.44%	130	10.54%
Market Impact								
Direct Sales	\$ 748,574	17.5%	\$ 346,919	18.7%	\$ 91,179	13.1%	\$ 26,627	10.3%
Direct Wages and Salaries	\$ 362,749	17.4%	\$ 168,585	18.7%	\$ 44,122	13.5%	\$ 13,333	10.3%
Direct Employment	12	16.7%	6	18.4%	1	13.5%	1	10.2%
Total Income								
Upper Bound	\$ 634,811	17.4%	\$ 295,024	18.7%	\$ 77,213	13.5%	\$ 23,332	10.3%
Lower Bound	\$ 544,123	17.4%	\$ 252,878	18.7%	\$ 66,183	13.5%	\$ 19,999	10.3%
Total Employment								
Upper Bound	18	16.7%	9	18.3%	2	13.3%	1	10.0%
Lower Bound	15	16.7%	7	18.4%	2	13.6%	1	9.5%
Non-Market Impact								
Consumer's Surplus	\$ 162,527	54.0%	\$ 71,608	57.4%	\$ 19,474	41.9%	\$ 4,689	32.8%
Profit ¹	\$ 21,867	13.9%	\$ 8,725	18.8%	\$ 1,203	6.7%	\$ 305	11.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.13. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	4,079	15.70%	1,821	16.90%	482	12.00%	130	10.54%
Market Impact								
Direct Sales	\$ 677,801	15.8%	\$ 317,349	17.1%	\$ 81,425	11.7%	\$ 26,627	10.3%
Direct Wages and Salaries	\$ 328,537	15.8%	\$ 154,119	17.1%	\$ 39,402	12.1%	\$ 13,333	10.3%
Direct Employment	11	15.2%	5	16.9%	1	12.0%	1	10.2%
Total Income								
Upper Bound	\$ 574,941	15.8%	\$ 269,708	17.1%	\$ 68,953	12.1%	\$ 23,332	10.3%
Lower Bound	\$ 492,806	15.8%	\$ 231,178	17.1%	\$ 59,103	12.1%	\$ 19,999	10.3%
Total Employment								
Upper Bound	16	15.2%	8	16.8%	2	11.8%	1	10.0%
Lower Bound	14	15.2%	7	16.9%	2	12.1%	1	9.5%
Non-Market Impact								
Consumer's Surplus	\$ 147,244	15.7%	\$ 65,744	16.9%	\$ 17,391	12.0%	\$ 4,689	10.5%
Profit ¹	\$ 20,188	12.8%	\$ 7,946	17.2%	\$ 1,074	6.0%	\$ 305	11.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.14. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	423	1.63%	162	1.51%	58	1.44%	-	0.00%
Market Impact								
Direct Sales	\$ 70,772	1.7%	\$ 29,569	1.6%	\$ 9,754	1.4%	\$ -	0.0%
Direct Wages and Salaries	\$ 34,211	1.6%	\$ 14,467	1.6%	\$ 4,720	1.4%	\$ -	0.0%
Direct Employment	1	1.5%	0	1.5%	0	1.4%	-	0.0%
Total Income								
Upper Bound	\$ 59,870	1.6%	\$ 25,316	1.6%	\$ 8,260	1.4%	\$ -	0.0%
Lower Bound	\$ 51,317	1.6%	\$ 21,700	1.6%	\$ 7,080	1.4%	\$ -	0.0%
Total Employment								
Upper Bound	2	1.5%	1	1.5%	0	1.4%	-	0.0%
Lower Bound	1	1.5%	1	1.5%	0	1.5%	-	0.0%
Non-Market Impact								
Consumer's Surplus	\$ 15,283	1.6%	\$ 5,864	1.5%	\$ 2,083	1.4%	\$ -	0.0%
Profit ¹	\$ 1,679	1.1%	\$ 780	1.7%	\$ 129	0.7%	\$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 2. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.15 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.15 presents a range of benefits with low end in terms of consumer's surplus of \$6,457 with the assumption of a 10% increase in quality and a 0.25 value elasticity of quality and a high end of \$1,162,343 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts range between \$25,760 and \$4,636,710, while employment impacts range between less than one job to 133 new jobs.

Table 3.15 Potential Benefits to Non-consumptive Users from Alternative 2 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.25	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	\$ 6,457	\$ 25,830	\$ 116,234
	Income	\$ 25,760	\$ 103,038	\$ 463,671
	Employment	0.74	2.96	13.32
	Person-days	179	716	3,220
50%				
	Consumer's Surplus	\$ 32,287	\$ 129,149	\$ 581,172
	Income	\$ 128,798	\$ 515,190	\$ 2,318,355
	Employment	3.70	14.80	66.60
	Person-days	895	3,578	16,101
100%				
	Consumer's Surplus	\$ 64,575	\$ 258,298	\$ 1,162,343
	Income	\$ 257,595	\$ 1,030,380	\$ 4,636,710
	Employment	7.40	29.60	133.21
	Person-days	1,789	7,156	32,202

1. Benefits are the aggregate amounts across all non-consumptive activities for Alternative 2

Alternative 3. In terms of impact associated with non-consumptive activities Alternative 3 is significantly smaller than the preferred alternative. The aggregate economic impact on income associated with all non-consumptive activities is about \$384 thousands dollars or 6.4% of the income generated in the study area. In terms of income, the activity with the highest baseline is non-consumptive diving with \$164 thousand, followed by whale watching with \$156 thousand, sailing with \$37 thousand and kayaking/sightseeing with \$25 thousand. Please see Tables 3.16 through 3.18 the remainder of the economic measures and breakout by jurisdiction.

Table 3.16. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	1,112	4.28%	1,175	10.90%	264	6.57%	136	11.00%
Market Impact								
Direct Sales	\$ 183,670	4.3%	\$ 192,526	10.4%	\$ 44,589	6.4%	\$ 28,472	11.1%
Direct Wages and Salaries	\$ 89,284	4.3%	\$ 93,983	10.4%	\$ 21,577	6.6%	\$ 14,304	11.1%
Direct Employment	3	4.3%	3	10.9%	1	6.6%	1	11.1%
Total Income								
Upper Bound	\$ 156,246	4.3%	\$ 164,471	10.4%	\$ 37,759	6.6%	\$ 25,032	11.1%
Lower Bound	\$ 133,926	4.3%	\$ 140,975	10.4%	\$ 32,365	6.6%	\$ 21,456	11.1%
Total Employment								
Upper Bound	5	4.3%	5	10.8%	1	6.5%	1	10.9%
Lower Bound	4	4.3%	4	10.9%	1	6.6%	1	10.4%
Non-Market Impact								
Consumer's Surplus	\$ 40,153	13.3%	\$ 42,409	34.0%	\$ 9,523	20.5%	\$ 4,894	34.3%
Profit ¹	\$ 6,660	4.2%	\$ 4,054	8.8%	\$ 588	3.3%	\$ 300	10.8%

1. Profit is used as a proxy for producer's surplus.

Table 3.17. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	1,108	4.26%	975	9.05%	232	5.78%	136	11.00%
Market Impact								
Direct Sales	\$ 182,925	4.3%	\$ 157,141	8.5%	\$ 39,234	5.7%	\$ 28,472	11.1%
Direct Wages and Salaries	\$ 88,920	4.3%	\$ 76,673	8.5%	\$ 18,985	5.8%	\$ 14,304	11.1%
Direct Employment	3	4.3%	3	9.0%	1	5.8%	1	11.1%
Total Income								
Upper Bound	\$ 155,610	4.3%	\$ 134,178	8.5%	\$ 33,224	5.8%	\$ 25,032	11.1%
Lower Bound	\$ 133,380	4.3%	\$ 115,010	8.5%	\$ 28,478	5.8%	\$ 21,456	11.1%
Total Employment								
Upper Bound	5	4.3%	4	9.0%	1	5.7%	1	10.9%
Lower Bound	4	4.3%	4	9.0%	1	5.8%	1	10.4%
Non-Market Impact								
Consumer's Surplus	\$ 39,989	4.3%	\$ 35,183	9.0%	\$ 8,380	5.8%	\$ 4,894	11.0%
Profit ¹	\$ 6,627	4.2%	\$ 3,173	6.9%	\$ 518	2.9%	\$ 300	10.8%

1. Profit is used as a proxy for producer's surplus.

Table 3.18. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	5	0.02%	200	1.86%	32	0.79%	-	0.00%
Market Impact								
Direct Sales	\$ 746	0.0%	\$ 35,385	1.9%	\$ 5,355	0.8%	\$ -	0.0%
Direct Wages and Salaries	\$ 364	0.0%	\$ 17,310	1.9%	\$ 2,591	0.8%	\$ -	0.0%
Direct Employment	0	0.0%	1	1.9%	0	0.8%	-	0.0%
Total Income								
Upper Bound	\$ 637	0.0%	\$ 30,292	1.9%	\$ 4,535	0.8%	\$ -	0.0%
Lower Bound	\$ 546	0.0%	\$ 25,965	1.9%	\$ 3,887	0.8%	\$ -	0.0%
Total Employment								
Upper Bound	0	0.0%	1	1.8%	0	0.8%	-	0.0%
Lower Bound	0	0.0%	1	1.9%	0	0.8%	-	0.0%
Non-Market Impact								
Consumer's Surplus	\$ 164	0.0%	\$ 7,226	1.9%	\$ 1,144	0.8%	\$ -	0.0%
Profit ¹	\$ 33	0.0%	\$ 881	1.9%	\$ 71	0.4%	\$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 3. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.19 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.19 presents a range of benefits with low end in terms of consumer's surplus of \$2,424 with the assumption of a 10% increase in quality and a 0.25 value elasticity of quality and a high end of \$436,406 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between \$9,588 and \$1,725,785, while employment impacts range between less than one job to 52 new jobs.

Table 3.19 Potential Benefits to Non-consumptive Users from Alternative 3 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.25	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	\$ 2,424	\$ 9,698	\$ 43,641
	Income	\$ 9,588	\$ 38,351	\$ 172,578
	Employment	0.29	1.16	5.23
	Person-days	67	269	1,209
50%				
	Consumer's Surplus	\$ 12,122	\$ 48,490	\$ 218,203
	Income	\$ 47,938	\$ 191,754	\$ 862,892
	Employment	1.45	5.82	26.17
	Person-days	336	1,344	6,046
100%				
	Consumer's Surplus	\$ 24,245	\$ 96,979	\$ 436,406
	Income	\$ 95,877	\$ 383,508	\$ 1,725,785
	Employment	2.91	11.63	52.34
	Person-days	672	2,687	12,092

1. Benefits are the aggregate amounts across all non-consumptive activities for Alternative 3

Alternative 4. In terms of impact associated with non-consumptive activities Alternative 4 is larger than the Preferred Alternative. The aggregate economic impact on income associated with all non-consumptive activities is about \$1.3 million dollars or 20.8% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with \$767 thousand, followed by non-consumptive diving with \$370 thousand, sailing with \$81 thousand and kayaking/sightseeing with \$32 thousand. Please see Tables 3.20 through 3.22 the remainder of the economic measures and breakout by jurisdiction.

Table 3.20. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary	% of Study	Boundary	% of Study	Boundary	% of Study	Boundary	% of Study
	Alternative	Area ²	Alternative	Area ²	Alternative	Area ²	Alternative	Area ²
Person-days	5,450	20.97%	2,505	23.25%	569	14.17%	174	14.13%
Market Impact								
Direct Sales	\$ 903,539	21.1%	\$ 434,389	23.4%	\$ 97,837	14.1%	\$ 36,097	14.0%
Direct Wages and Salaries	\$ 438,372	21.0%	\$ 211,439	23.5%	\$ 46,329	14.2%	\$ 18,101	14.0%
Direct Employment	15	20.5%	7	23.2%	1	14.2%	1	13.9%
Total Income								
Upper Bound	\$ 767,151	21.0%	\$ 370,018	23.5%	\$ 81,076	14.2%	\$ 31,676	14.0%
Lower Bound	\$ 657,558	21.0%	\$ 317,159	23.5%	\$ 69,493	14.2%	\$ 27,151	14.0%
Total Employment								
Upper Bound	22	20.6%	11	23.1%	2	13.9%	1	13.7%
Lower Bound	19	20.6%	9	23.2%	2	14.3%	1	13.0%
Non-Market Impact								
Consumer's Surplus	\$ 196,695	65.4%	\$ 90,416	72.5%	\$ 20,540	44.2%	\$ 6,290	44.1%
Profit ¹	\$ 28,847	18.3%	\$ 10,645	23.0%	\$ 2,227	12.4%	\$ 399	14.4%

1. Profit is used as a proxy for producer's surplus.

Table 3.21. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	4,272	16.44%	2,194	20.36%	518	12.89%	174	14.13%
Market Impact								
Direct Sales	\$ 709,897	16.6%	\$ 378,420	20.4%	\$ 89,135	12.8%	\$ 36,097	14.0%
Direct Wages and Salaries	\$ 344,085	16.5%	\$ 184,058	20.5%	\$ 42,118	12.9%	\$ 18,101	14.0%
Direct Employment	11	15.9%	6	20.4%	1	12.9%	1	13.9%
Total Income								
Upper Bound	\$ 602,149	16.5%	\$ 322,101	20.5%	\$ 73,706	12.9%	\$ 31,676	14.0%
Lower Bound	\$ 516,127	16.5%	\$ 276,087	20.5%	\$ 63,177	12.9%	\$ 27,151	14.0%
Total Employment								
Upper Bound	17	15.9%	10	20.2%	2	12.7%	1	13.7%
Lower Bound	14	15.9%	8	20.3%	2	13.0%	1	13.0%
Non-Market Impact								
Consumer's Surplus	\$ 154,207	16.4%	\$ 79,202	20.4%	\$ 18,681	12.9%	\$ 6,290	14.1%
Profit ¹	\$ 21,098	13.4%	\$ 9,198	19.9%	\$ 2,112	11.7%	\$ 399	14.4%

1. Profit is used as a proxy for producer's surplus.

Table 3.22. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	1,177	4.53%	311	2.88%	51	1.28%	-	0.00%
Market Impact								
Direct Sales	\$ 193,641	4.5%	\$ 55,968	3.0%	\$ 8,702	1.3%	\$ -	0.0%
Direct Wages and Salaries	\$ 94,287	4.5%	\$ 27,381	3.0%	\$ 4,211	1.3%	\$ -	0.0%
Direct Employment	3	4.6%	1	2.9%	0	1.3%	-	0.0%
Total Income								
Upper Bound	\$ 165,003	4.5%	\$ 47,917	3.0%	\$ 7,369	1.3%	\$ -	0.0%
Lower Bound	\$ 141,431	4.5%	\$ 41,072	3.0%	\$ 6,316	1.3%	\$ -	0.0%
Total Employment								
Upper Bound	5	4.6%	1	2.9%	0	1.3%	-	0.0%
Lower Bound	4	4.6%	1	2.9%	0	1.3%	-	0.0%
Non-Market Impact								
Consumer's Surplus	\$ 42,488	4.5%	\$ 11,214	2.9%	\$ 1,859	1.3%	\$ -	0.0%
Profit ¹	\$ 7,748	4.9%	\$ 1,447	3.1%	\$ 115	0.6%	\$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 4. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.23 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.23 presents a range of benefits with low end in terms of consumer's surplus of \$7,849 with the assumption of a 10% increase in quality and a 0.25 value elasticity of quality and a high end of \$1,412,732 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between \$31,248 and \$5,624,646, while employment impacts range between less than one job to about 164 new jobs.

Table 3.23 Potential Benefits to Non-consumptive Users from Alternative 4 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.25	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	\$ 7,849	\$ 31,394	\$ 141,273
	Income	\$ 31,248	\$ 124,992	\$ 562,465
	Employment	0.91	3.64	16.37
	Person-days	217	870	3,914
50%				
	Consumer's Surplus	\$ 39,243	\$ 156,970	\$ 706,366
	Income	\$ 156,240	\$ 624,961	\$ 2,812,323
	Employment	4.55	18.19	81.85
	Person-days	1,087	4,349	19,571
100%				
	Consumer's Surplus	\$ 78,485	\$ 313,940	\$ 1,412,732
	Income	\$ 312,480	\$ 1,249,921	\$ 5,624,646
	Employment	9.09	36.38	163.70
	Person-days	2,175	8,698	39,141

1. Benefits are the aggregate amounts across all non-consumptive activities for Alternative 4

Alternative 5. In terms of impact associated with non-consumptive activities Alternative 5 is significantly larger than the preferred alternative. The aggregate economic impact on income associated with all non-consumptive activities is about \$1.5 million dollars or 25.5% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with \$939 thousand, followed by non-consumptive diving with \$431 thousand, sailing with \$96 thousand and kayaking/sightseeing with \$71 thousand. Please see Tables 3.24 through 3.26 the remainder of the economic measures and breakout by jurisdiction.

Table 3.24. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	6,670	25.67%	2,901	26.93%	672	16.75%	386	31.31%
Market Impact								
Direct Sales	\$ 1,104,869	25.8%	\$ 504,751	27.2%	\$ 116,137	16.7%	\$ 80,471	31.3%
Direct Wages and Salaries	\$ 536,287	25.7%	\$ 246,032	27.3%	\$ 54,677	16.8%	\$ 40,387	31.2%
Direct Employment	18	25.2%	8	26.9%	2	16.8%	2	31.2%
Total Income								
Upper Bound	\$ 938,502	25.7%	\$ 430,556	27.3%	\$ 95,685	16.8%	\$ 70,676	31.2%
Lower Bound	\$ 804,430	25.7%	\$ 369,048	27.3%	\$ 82,016	16.8%	\$ 60,580	31.2%
Total Employment								
Upper Bound	27	25.3%	13	26.7%	3	16.5%	2	30.7%
Lower Bound	23	25.3%	10	26.8%	2	16.9%	2	29.2%
Non-Market Impact								
Consumer's Surplus	\$ 240,754	80.0%	\$ 104,723	83.9%	\$ 24,270	52.2%	\$ 13,934	97.6%
Profit ¹	\$ 36,362	23.1%	\$ 12,367	26.7%	\$ 2,936	16.3%	\$ 870	31.5%

1. Profit is used as a proxy for producer's surplus.

Table 3.25. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	4,901	18.86%	2,542	23.59%	609	15.17%	386	31.31%
Market Impact								
Direct Sales	\$ 814,227	19.0%	\$ 439,779	23.7%	\$ 105,427	15.2%	\$ 80,471	31.3%
Direct Wages and Salaries	\$ 394,686	18.9%	\$ 214,245	23.8%	\$ 49,494	15.2%	\$ 40,387	31.2%
Direct Employment	13	18.2%	7	23.6%	2	15.2%	2	31.2%
Total Income								
Upper Bound	\$ 690,701	18.9%	\$ 374,930	23.8%	\$ 86,615	15.2%	\$ 70,676	31.2%
Lower Bound	\$ 592,030	18.9%	\$ 321,368	23.8%	\$ 74,242	15.2%	\$ 60,580	31.2%
Total Employment								
Upper Bound	20	18.3%	11	23.4%	2	14.9%	2	30.7%
Lower Bound	16	18.3%	9	23.5%	2	15.3%	2	29.2%
Non-Market Impact								
Consumer's Surplus	\$ 176,903	18.9%	\$ 91,736	23.6%	\$ 21,983	15.2%	\$ 13,934	31.3%
Profit ¹	\$ 24,353	15.5%	\$ 10,680	23.1%	\$ 2,795	15.5%	\$ 870	31.5%

1. Profit is used as a proxy for producer's surplus.

Table 3.26. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kavaking/Sightseeing	
	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²	Boundary Alternative	% of Study Area ²
Person-days	1,769	6.81%	360	3.34%	63	1.58%	-	0.00%
Market Impact								
Direct Sales	\$ 290,642	6.8%	\$ 64,973	3.5%	\$ 10,710	1.5%	\$ -	0.0%
Direct Wages and Salaries	\$ 141,600	6.8%	\$ 31,786	3.5%	\$ 5,183	1.6%	\$ -	0.0%
Direct Employment	5	7.0%	1	3.3%	0	1.6%	-	0.0%
Total Income								
Upper Bound	\$ 247,801	6.8%	\$ 55,626	3.5%	\$ 9,070	1.6%	\$ -	0.0%
Lower Bound	\$ 212,401	6.8%	\$ 47,680	3.5%	\$ 7,774	1.6%	\$ -	0.0%
Total Employment								
Upper Bound	8	7.0%	2	3.3%	0	1.6%	-	0.0%
Lower Bound	6	7.0%	1	3.3%	0	1.6%	-	0.0%
Non-Market Impact								
Consumer's Surplus	\$ 63,852	6.8%	\$ 12,987	3.3%	\$ 2,287	1.6%	\$ -	0.0%
Profit ¹	\$ 12,009	7.6%	\$ 1,688	3.6%	\$ 141	0.8%	\$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 5. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.27 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.27 presents a range of benefits with low end in terms of consumer's surplus of \$9,592 with the assumption of a 10% increase in quality and a 0.25 value elasticity of quality and a high end of \$1,726,565 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between \$38,385 and \$6,909,387, while employment impacts range between about one job to 202 new jobs.

Table 3.27 Potential Benefits to Non-consumptive Users from Alternative 5 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.25	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	\$ 9,592	\$ 38,368	\$ 172,656
	Income	\$ 38,385	\$ 153,542	\$ 690,939
	Employment	1.12	4.50	20.23
	Person-days	266	1,063	4,784
50%				
	Consumer's Surplus	\$ 47,960	\$ 191,841	\$ 863,282
	Income	\$ 191,927	\$ 767,710	\$ 3,454,693
	Employment	5.62	22.48	101.17
	Person-days	1,329	5,315	23,918
100%				
	Consumer's Surplus	\$ 95,920	\$ 383,681	\$ 1,726,565
	Income	\$ 383,855	\$ 1,535,419	\$ 6,909,387
	Employment	11.24	44.96	202.34
	Person-days	2,658	10,630	47,835

1. Benefits are the aggregate amounts across all non-consumptive activities for Alternative 5

Table 3.28. Summary: Economic Impacts on Recreation Non-consumptive Activities - Step 2 Analysis

Alternative	Range of Impacts											
	Person-days				Consumer's Surplus							
	Amount		%		Amount		%					
Preferred Alternative	179	-	32,211	0.43%	-	77%	\$6,459	-	\$1,162,649	0.43%	-	77%
Alternative 1	67	-	12,092	0.16%	-	29%	\$2,299	-	\$413,737	0.15%	-	27%
Alternative 2	179	-	32,202	0.43%	-	77%	\$6,457	-	\$1,162,343	0.43%	-	77%
Alternative 3	67	-	12,092	0.16%	-	29%	\$2,424	-	\$436,406	0.16%	-	29%
Alternative 4	217	-	39,141	0.52%	-	93%	\$7,849	-	\$1,412,732	0.52%	-	93%
Alternative 5	266	-	47,835	0.63%	-	114%	\$9,592	-	\$1,726,565	0.63%	-	114%

Alternative	Income				Employment							
	Amount		%		Amount		%					
	Preferred Alternative	\$26,055	-	\$4,689,833	0.43%	-	78%	0.75	-	135	0.42%	-
Alternative 1	\$9,566	-	\$1,721,895	0.16%	-	29%	0.29	-	51	0.16%	-	28%
Alternative 2	\$25,760	-	\$4,636,710	0.43%	-	77%	0.74	-	133	0.41%	-	74%
Alternative 3	\$9,588	-	\$1,725,785	0.16%	-	29%	0.29	-	52	0.16%	-	29%
Alternative 4	\$31,248	-	\$5,624,646	0.52%	-	93%	0.91	-	164	0.51%	-	92%
Alternative 5	\$38,385	-	\$6,909,387	0.64%	-	115%	1.12	-	202	0.63%	-	113%

1. Percents are percent of baseline 1999 for the entire study area.

Other Potential Benefits and Net Assessment

In previous sections we addressed the potential costs to all consumptive users (both the recreational industry and for the commercial fishery and kelp), we discussed the potential benefits to recreational consumptive users and commercial fisheries from the replenishment effect of the marine reserves. We also discussed the potential benefits to nonconsumptive recreational users and simulated the potential benefits using a range of assumptions about future quality increases in the marine reserves and the behavioral responses (quality elasticities). In the introduction of the report, we introduced the concepts of nonuse or passive economic use values. Here we derive some rough estimates for nonuse or passive use economic values using a conservative range of values from the economics literature and some assumptions about how many American households might be willing to pay for marine reserves in the CINMS. We summarize some key National and California Statewide surveys to provide underlying support for the notion that people are willing to pay for marine reserves. Lastly, we provide a rough assessment of the Net National Benefits of marine reserves in the CINMS. We do this by overstating the amounts of consumer's surplus losses for the commercial fisheries and kelp and consumptive recreation activities and use conservative lower bound estimates for nonuse or passive use economic values. Although we show a range of values for nonconsumptive recreation, we did not add these in the Net Benefit Assessment. The net national benefits of marine reserves are greater than the costs by considering only the nonuse or passive use economic values for any of the alternatives, except under the most conservative assumptions for the largest reserve alternatives proposed for the CINMS. If we added the highest range of nonconsumptive recreation value to nonuse or passive economic use value, the consumptive use values lost would exceed the benefits only for Alternative 5 under the most conservative assumptions for nonuse or passive economic use value.

Nonuse or Passive Use Economic Value. To date there are no known studies that have estimated nonuse or passive use economic values specifically for the marine reserves in the CINMS or for marine reserves anywhere else. However, Spurgeon (1992) has offered two sets of identifiable factors, which will dictate the magnitude of nonuse or passive use economic values. First, nonuse economic values will be positively related to the quality, condition, and uniqueness of the ecosystem on a national or global scale. Second, the size of population, standard of education, and environmental perception of people in the country owning or having jurisdiction over the ecosystem will be positively related to nonuse or passive use economic values. Thus, nonuse or passive use economic values are determined by both supply and demand conditions. The existence of many similar sites would reduce the value. Although Spurgeon limits his scope to the people in the country owning or having jurisdiction over the ecosystem, people from all over the world may have nonuse or passive use economic values for ecosystem protection in other countries. Debt for nature protection swaps being conducted by The Nature Conservancy in South America is just one example. Legitimacy of including the values of people from other countries is more a judicial concern than an economic one. In some judicial proceedings people from other countries might not have legal standing over issues of resource protection and their economic values may be eliminated from inclusion in the proceedings.

An important criterion for evaluating the legitimacy of estimated nonuse or passive economic use values is referred to the scale or scope test. The scale or scope test is based on the premise that more of a good or service should have higher value than less of a good or service. When consumers are presented with a valuation scenario, a larger marine reserve that provides more habitat protection should have more value than a smaller marine reserve that provides less habitat protection.

The U.S. population is certainly a high income and highly educated population and, as the results above predictably show, the U.S. and California population has high environmental concern and overwhelmingly supports the creation of marine reserves. Clearly on the demand side, our assumption that only one (1) or two (2) percent of the U.S. households would be willing to pay some amount for marine reserves in the Channel Islands National Marine Sanctuary (CINMS) seem extremely conservative.

On the supply side, the CINMS is one of only 13 National Marine Sanctuaries, two of which only protect cultural resources (Monitor and Thunder Bay). The other 11 represent special marine resources. National Marine Sanctuaries have special recognition. Each goes through a public process to be established. Congress must approve the designation and the President must sign the legislation before a proposed area becomes a National Marine Sanctuary. To date only 11 marine areas protecting natural resources in the U.S. have been established as National Marine Sanctuaries.

Contrast Prince William Sound (site of the Exxon Valdez Oil Spill) with the CINMS. Prince William Sound doesn't have the special recognition as a National Marine Sanctuary and is not recognized, as a Marine Protected Area (MPA) i.e., there is no law specifically recognizing Prince William Sound as a special marine area. However, Carson et al (1992) were able to show that 90 percent of U.S. households were willing to pay \$31 per household for a ten-year protection program for Prince William Sound.

Given the demand and supply information above, it would seem that our assumption of only one (1) or two (2) percent of U.S. households being willing to pay some amount is extremely conservative.

Characteristics of the people valuing the reserve would be constant (U.S. Households) across different proposed marine reserve boundary alternatives. To differentiate among alternatives would require that we compare some measurements that would serve as indicators of the relative quality, condition and uniqueness of the proposed reserves across alternatives. We have some information compiled on 15 habitat types protected by each alternative.

Alternative 1. This alternative is the smallest in size at approximately 186.5 nautical square miles and overall protects 12 percent of CINMS waters. Only three of the 15 habitats receive 20 percent or more of protection and only two habitats receive more than 30 percent protection. This alternative should have the lowest nonuse or passive economic use value.

Alternative 2. This alternative is the second smallest in size at approximately 213.1 nautical square miles and overall protects 14 percent of CINMS waters. Only four of the 15 habitats receive 20 percent or more of protection and only one habitat receives more than 30 percent protection. People may not be able to distinguish this alternative from alternative 1 without more information.

Alternative 3. This alternative is the third smallest in size at approximately 306.5 nautical square miles and overall protects 21 percent of CINMS waters. Only six of the 15 habitats receive 20 percent or more of protection and only two habitats receive more than 30 percent protection. This alternative would be expected to have higher nonuse or passive use economic value than alternatives 1 and 2.

Alternative 4. This alternative is the second largest in size at approximately 450.1 nautical square miles and overall protects 29 percent of CINMS waters. 14 of the 15 habitats receive 20 percent or more of protection and six habitats receive more than 30 percent protection. This alternative would be expected to have higher nonuse or passive economic use value than alternatives 1, 2, 3 and the preferred alternative.

Alternative 5. This alternative is the largest in size at approximately 516.4 nautical square miles and overall protects 34 percent of CINMS waters. All 15 habitats receive 24 percent or more of protection and

nine habitats receive more than 30 percent protection. This alternative would be expected to have the highest nonuse or passive use economic value among all alternatives.

Preferred Alternative. This alternative is mid-range in size at approximately 369.6 nautical square miles and overall protects 25 percent of CINMS waters. All 15 habitats receive 21 percent or more of protection and eight habitats receive more than 30 percent protection. This alternative would be expected to have nonuse or passive use economic value somewhere between that between alternatives 3 and 4.

Scientific and Education Values. Marine reserves provide a multitude of benefits. Sobel (1996) provides a long list of these benefits. Most of those benefits have been covered in Chapter 1 and 2 and in our discussion of nonuse economic benefits above. Scientific and education values were categorized by Sobel into those things a reserves provides that increase knowledge and understanding of marine systems. Sobel provides the following lists of benefits:

Scientific

- Provides long-term monitoring sites
- Provides focus for study
- Provides continuity of knowledge in undisturbed site
- Provides opportunity to restore or maintain natural behaviors
- Reduces risks to long-term experiments
- Provides controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts

Education

- Provides sites for enhanced primary and adult education
- Provides sites for high-level graduate education

We cannot quantify these benefits, but they are extremely important.

Net Assessment

Here we provide a net assessment using the National Net Benefits Approach. Under this approach, only consumer's surplus and economic rent values are appropriate for consideration, as in a formal benefit-cost analysis. We are not able to quantify all the costs and benefits, especially not across all alternatives, as with the nonuse or passive economic use values. But with certain assumptions designed to bias the result in favor of the consumptive activities, we show that the nonuse or passive economic use values would likely exceed all consumptive use values. ***Thus, there would be net national benefits to adopting any of the alternatives for the proposed marine reserves in the CINMS.***

Commercial Fishing and Kelp. We concluded in Chapter 1 that the supplies of CINMS caught commercial fish were not a high enough proportion of total supply to affect prices. Squid and urchins are primarily sold in international markets and CINMS total catch is only 2.15% of world supply for squid and 2.24% of world supply for urchins. The proportions of supply impacted by each marine reserve alternative would be far too small to impact prices and consumer's surplus impacts from each alternative would be zero. For squid and urchins the percent of world supply impacted varies between about one-tenth of one percent to one half of one percent. Also, we have found no evidence that economic rents exist in the CINMS fisheries. For the largest commercial fishery, squid, there appears to be economic overfishing and possibly negative economic rents.

Although there are no “price effects” expected and therefore losses in consumer’s surplus and the fact the commercial fisheries are most likely all characterized by economic overfishing i.e., no economic rents or negative economic rents, there still may be some losses on the producer side of commercial fishing.

The usual assumptions of benefit-cost analysis are that the economy is at full employment and that displaced labor and capital are mobile and can find alternative employment. Adhering to our “maximum potential loss assumption, we relax the two assumptions in benefit-cost analysis and assume that displaced labor and capital will not be able to find alternative employment.

Good costs and earnings studies were not available for California or Channel Islands commercial fisheries. So, we used cost and return studies conducted for the Gulf of Mexico fisheries as applied to the commercial fisheries in analyzing the impacts of creating the Tortugas Ecological Reserve in the Florida Keys National Marine Sanctuary (See Leeworthy and Wiley, 1999). The returns to labor and capital include all labor, including captain’s wages and return to owner’s capital investment in the fishery. Across all fisheries the average return to labor and capital was normalized to returns to labor and capital as a percent of harvest revenue (27.98%). We applied this percentage of estimated harvest revenue under Step 1 Analysis (maximum potential loss) for each marine reserve alternative (Table 3.29).

Table 3.29. Net Assessment: National Net Benefits of Marine Reserves in the CINMS

Use	Alternatives					
	1	2	3	4	5	Preferred
Costs						
Recreation Consumptive	\$ 1,437,436	\$ 2,533,299	\$ 1,637,119	\$ 3,121,889	\$ 3,687,129	\$ 2,746,600
Commercial Fisheries and Kelp	\$ 604,915	\$ 621,574	\$ 662,574	\$ 1,159,577	\$ 1,438,042	\$ 985,488
Total Consumptive	\$ 2,042,351	\$ 3,154,873	\$ 2,299,693	\$ 4,281,466	\$ 5,125,171	\$ 3,732,088
Benefits						
Recreation Non-consumptive						
Mid-range (50% quality increase, elasticity 1.0)	\$ 45,971	\$ 129,149	\$ 48,490	\$ 156,970	\$ 191,841	\$ 129,183
Highest (100% quality increase, elasticity 4.5)	\$ 413,737	\$ 1,162,343	\$ 436,406	\$ 1,412,732	\$ 1,726,565	\$ 1,162,649
Nonuse/Passive Economic Use (1% U.S. Households)						
Lowest (\$3.12 million)	+	-	+	-	-	-
Mid-range (\$5.19 million)	+	+	+	+	+	+
Highest (\$10.39 million)	+	+	+	+	+	+
Nonuse/Passive Economic Use (2% U.S. Households)						
Lowest (\$3.12 million)	+	+	+	+	+	+
Mid-range (\$5.19 million)	+	+	+	+	+	+
Highest (\$10.39 million)	+	+	+	+	+	+

1. "+" means nonuse values higher than consumptive use values, "-" means nonuse values are lower than consumptive use values.

Recreation Consumptive Activities. We use our Step 1 analysis estimates and ignore the offsetting factors discussed at the beginning of this chapter that indicate much of the losses in Step 1 would not likely occur. Again, the effect here will be to bias the analysis towards the consumptive users.

Nonconsumptive Recreation Activities. We simulated a range of potential benefits for a portion of the group that we were able to include in our analyses, i.e., those doing nonconsumptive activities using the for hire or charter/party/guide boat businesses. We were not able to find any information to estimate the amount of nonconsumptive use from private household/rental boats in the CINMS. We include a mid-range and upper range of values estimated for the charter/party/guide boat nonconsumptive users. Because the nonconsumptive private household boat use is not included, again our estimates are biased towards the consumptive users.

Table 3.29 summarizes the results of our National Net Benefits Assessment. The “+” at the bottom of the table means that, when comparing only the nonuse or passive economic use values with the sum of the consumptive use values, the nonuse or passive economic use values are higher. A “-” means that nonuse/passive economic use values are lower. We conduct the assessment using the two policy simulation assumptions, 1) one percent of U.S. households are willing to pay the three different dollar amounts, and 2) two percent of U.S. households are willing to pay the three different dollar amounts. Under the one percent assumption, losses in consumptive activities exceed the nonuse/passive economic use values for alternatives 2, 4, 5 and the preferred alternative. Under the 2 percent assumption, nonuse/passive economic

use value exceeds the losses. *Thus, we would expect that there would be net national benefits from adopting any of the marine reserve alternatives except under the most conservative assumptions for the largest reserve alternatives.*

Net National Benefits Approach versus Local Income and Employment

Economists for years have been trying to explain cost-benefit analysis or the net national benefits approach. Even though cost-benefit analysis has been widely excepted in public policy and management many still don't understand the concepts of consumer's surplus, producer's surplus or economic rent used by economists in cost-benefit analysis. Many understand sales, income and employment numbers and how this relates to their local economies. But, generally these measures are not appropriate inputs into the cost-benefit calculation. They enter the analysis indirectly when one of the major assumptions of cost-benefit analysis is violated i.e., that the economy is at full employment and any displaced capital or labor can easily find employment. When the economy is not at full employment or capital and labor cannot simply find alternative employment, this leads to real economic costs that must included. There are also issues of equity or fairness that are not addressed in cost-benefit analysis. To address this issue some public agencies have asked that the distribution of costs and benefits be included in analyses.

The net national benefits approach versus the local income and employment approach partially addresses this question of the distribution of benefits and costs. As we showed above in the net national benefits exercise, the main benefits of marine reserves came from national sources that are highly dispersed across the country. Nonuse or passive economic use values will be dispersed widely across people throughout the country. There is no income and employment impacts associated with nonuse or passive use values, except the media sources, which are the basis for people finding out about the resources they value. Consumer's surplus values from changes in supply of commercial fishing products are also widely dispersed and, for many CINMS species, consumers would include foreign consumers. The potential income and employment impacts are largely concentrated in the local communities adjacent to the CINMS. If there are trade-offs, they might entail distributions of national benefits with most of the costs born locally. This is true for many goods and services where there might be high net national benefits, but the costs are concentrated (e.g. pollution and undesirable industrial development) in local areas. Oil and gas development is certainly one of these types of issues. Benefits are often small per individual dispersed across the whole country, while costs are high per a small number of individuals concentrated in local areas.

Why don't economists want to include income and employment impacts in cost-benefit analysis? The general answer is that is people don't spend their money on one thing they will spend it on something else. So, one person's loss is another person's gain. This is the issue of substitution we discussed in our Step 2 analysis, but on a broader scale. If someone is displaced from their favorite recreational fishing spot and decide to not go fishing, but instead go to out to a restaurant and see a movie. This too has sales, income and employment impacts that would partially or even fully off set the sales, income and employment impacts in the local economy of the lost fishing day. If people don't go fishing or diving, they will do something else and that something else will generally involve some activity which requires some spending. That spending will partially or fully off set the impacts on sales, income and employment. There may be different patterns of spending. And, it may be an issue of one person's loss is another person's gain. The net effect could be zero, in terms of total local sales, income and employment, or it could be lower sales, income and employment locally, but no difference from a State, Region or National perspective. The same is not true for the net national benefits approach. The concepts of consumer's surplus, producer's surplus and economic rents are net benefits and costs. They may have different distributions, but they are by definition net benefits and costs and do not cancel each other out. This is why economists don't include income and employment in cost-benefit analyses.

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